Monitoring AFL Footballers and Training Load

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Australian Rules Football imposes a significant physiological load on the player. The physiological demands on AFL players can compromise recovery and impair performance. To ensure performance consistency and to avoid overtraining, monitoring methods of training loads and testing can provide assistance with prescribing training loads.

KEYWORDS: Training Load, Blood Glucose and Lactate Test, Training Diary, Overtraining.

INTRODUCTION

Australian Football League (AFL) is becoming faster due to improved ground surfaces, contemporary training and playing methods, increased number of interchange players and technical resources. Throughout a game, most player intensities range from repeated bouts of explosive sprinting to low intensity bouts of jogging, walking or standing. It has been previously documented that mean heart rates for a total game time of two hours exceeded 165 beats per minute (Buttifant 1999). Recent research in soccer demonstrates that muscle glycogen depletion represents an important factor in the fatigue process (Bangsbo 1994). Therefore it would be apparent that the physiological load imposed on some AFL players would reflect similar responses to that of soccer players. Little is known about the player's recovery time following an AFL game, and when the optimal period is to resume high intensity training. Monitoring blood glucose and lactate responses post performance, theoretically, provides metabolic feedback as an indirect method of assessing recovery. Monitoring the player closely can contribute to the prevention of overtraining and subsequently sustain quality performance.

REVIEW OF LITERATURE

AFL is a unique game that has specific requirements for various playing positions which utilise anaerobic and aerobic pathways. Due to the lack of research on AFL, soccer provides a relatively good counterpart to make comparisons. It has been presented that fatigue at the end of a soccer match maybe related to depletion of muscle glycogen stores and subsequently a progressive decrease in the glycolytic rate when intense exercise is repeated (Bangsbo, 1994). A decreased glycolytic rate and lower muscle glycogen concentrations may explain lower blood lactate concentrations in the second half of the game, and a subsequent decrease in game intensity (Bangsbo, 1994). This has been supported by Norton et al. (2000), whose data demonstrates a progressive decrease in game speed throughout game time in AFL. An AFL players ability to repeatedly execute bouts of high intensity can have a significant influence on the outcome of the game. It has been shown that prolonged exercise involving endurance and speed with work rates exceeding 75 percent of maximal oxygen uptake is affected by initial muscle glycogen content (Saltin and Gollnick, 1983). The physiological responses throughout an AFL game would produce similar or greater work rates to that of the aforementioned (Buttifant 1999). It has been postulated that lower muscle glycogen concentration can result in a state of energetic deficiency, which leads to an impairment of the muscle's contractile processes (Sahlin et al. 1990). It has been purported that if players who have not fully replenished their muscle and liver glycogen stores would subsequently produce sub optimal performance. Also, athletes who have decreased muscle glycogen stores during exercise exhibit a hypoglycemic response (Pruett,1971). The physiological status of the player following a game could vary significantly within 24 to 72 hours, depending on game workrates, nutritional and health status. To impose an increased training load within this time frame could have a detrimental response on replenishing muscle and liver glycogen uptake and subsequently compromise performance. It has been previously reported that various substrates for exercise metabolism is primarily determined by exercise intensity and duration, although training status, dietary manipulation and environmental factors can modify the metabolic response to exercise (Hargreaves, 2000). However,

a decline in exercise performance is not necessarily related to a reduction in muscle glycogen but alternatively it may be attributed by other contributing factors (Hargreaves et al. 1998).

Overtraining syndrome is a serious problem amongst elite athletes and it is marked by decreased performance attributed by a variety of contributing factors (Uusitalo, 2001). In field sports the regular measurements of blood indices are used to diagnose and possibly prevent an overtraining syndrome (Stone et al, 1991). The frequent occurrence of overreaching or overtraining however, still contrasts with the availability of valid diagnostic tools (Urhausen et al. 1998). The pathology and physiology of overtraining syndrome remains unclear and more research is warranted to identify reliable diagnsotic tests to recognise the early warning signs (Uusitalo, 2001). There are many physiological and psychological parameters that may change as a result of overtraining and unfortunately there is no consensus as to which factors reliably indicate the syndrome (Mackinnon et al, 1996). Daily self-ratings of wellbeing have previously been recommended as an effective tool for early recognition of a trend towards overtraining (Mackinnon et al, 1996).

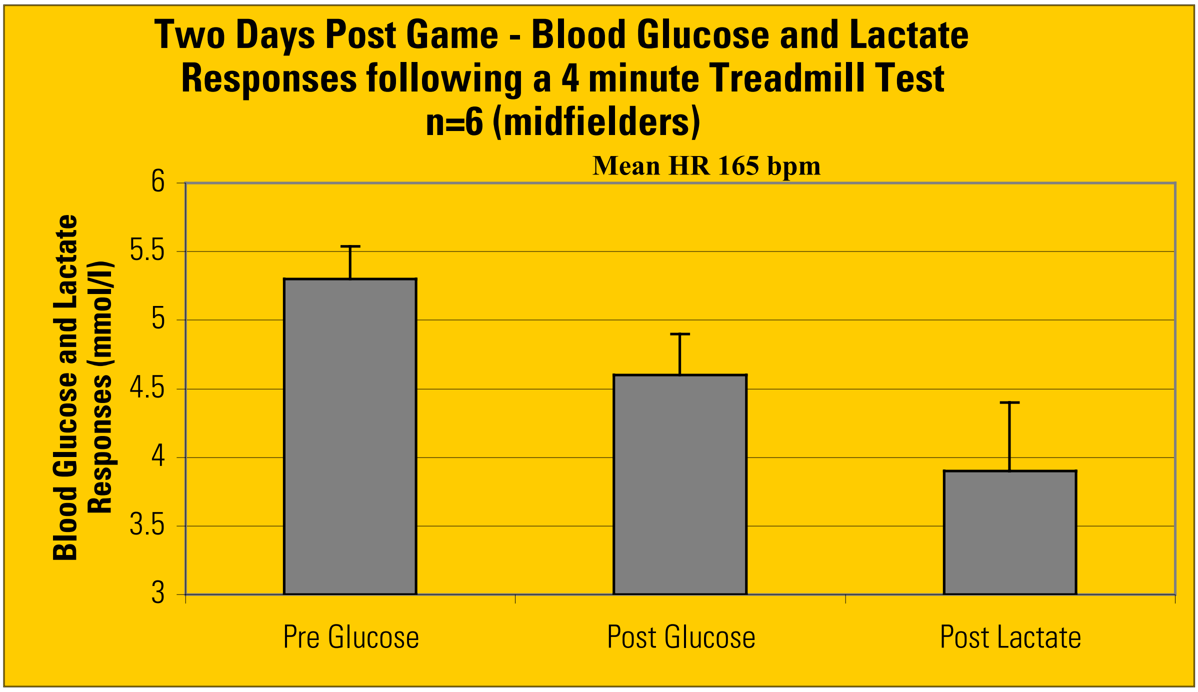
The Collingwood Football Club have used Self Monitoring Diaries in conjunction with an Exercise Test and blood markers to monitor physiological changes which maybe attributed towards staleness. Blood glucose, lactate and heart rate responses pre and post a moderate intensity running test on a treadmill were measured to assist with evaluating recovery status.

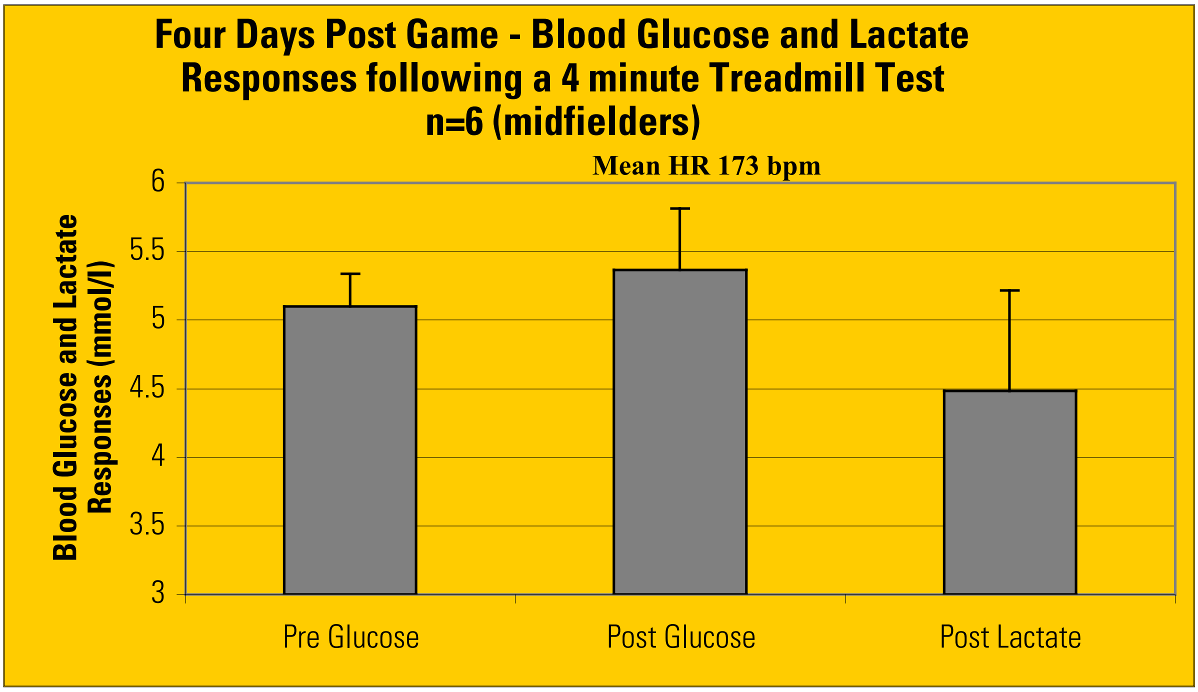
METHODOLOGY

Players were required to do the following:

- To be fasted by at least two hours prior to testing
- Wear a Polar Heart Rate monitor
- Pre Blood Glucose measured by a Portable Blood Glucose Analyser (Roche. Advantage)
- Pre Blood Lactate measured by a Portable Blood Lactate Test Meter (Arkray. Lactate Pro)
- Run on a treadmill for 1 minute @ 10kph at 3% grade for initial warm up then 3 minutes at 15kph at 3% grade.
- 1 minute post test blood glucose and lactate was measured

Results


Two Days Post Game - Blood Glucose and Lactate Responses following a 4 minute Treadmill Test n=6 (midfielders)
Mean HR 165 bpm
Blood Glucose and Lactate Responses (mmol/l)
6
5.5
5
4.5
4
3.5
3
Pre Glucose
Post Glucose
Post Lactate


Four Days Post Game - Blood Glucose and Lactate Responses following a 4 minute Treadmill Test n=6 (midfielders)
Mean HR 173 bpm
Blood Glucose and Lactate Responses (mmol/l)
6
5.5
5
4.5
4
3.5
3
Pre Glucose
Post Glucose
Post Lactate

DISCUSSION

An important observation was noted when the midfielders were tested on a 4 minute treadmill exercise test 48 hours post game (TET48) which showed suppressed post exercise blood glucose, lactate responses and heart rates. Whereas when the midfielders were tested 96 hours post game (TET96) the responses were not blunted. There has been a theory postulated by Costill et al 1988, that reduced muscle glycogen would contribute significantly to fatigue and result in a decrease in exercise performance. However, the glycogen theory has not been substantiated but maybe a mechanism contributing to the development of overtraining syndrome (Smith, 1999). Costill and colleagues also presented that when muscle glycogen levels are decreased, a delayed muscle glycogen resynthesis occurs. This may account for the blunted blood glucose and lactates responses post TET48. However, a substrate shift may have occurred throughout the TET48, which could explain the hypoglycemic response and lower blood lactate concentration as compared with the TET 96. Blunted heart rate responses were observed throughout the TET48 post which would explain suppressed sympathetic nervous activity, which is a sensitive parameter relating to overtraining (Kuipers, 1998). Therefore, the possibility of a substrate shift in the TET48 is unlikely, particularly with an increase release of free fatty acids being attributed by an increase in sympathetic nervous activity. A suppressed sympathetic system compromises catecholamine secretion and subsequently decreases heart rate and blood glucose responses during exercise (Galbo, 1983).

Overtraining syndrome is very complicated and can be attributed by a myriad of contributing mechanisms which causes a disturbance in homeostasis (Kuipers, 1998). Measuring blood glucose, lactate and heart rate responses following a TET can provide valuable information on indirect metabolic and hormonal status. Using this method in conjunction with a self-monitoring diary assists in assessing recovery and any potential physiological disturbances which could compromise performance.

CONCLUSIONS AND RECOMMENDATIONS

The rationale of potential mechanisms contributing to blunted physiological responses from the TET remain inconclusive, however, they may be useful in monitoring athletes recovery from competition. In addition to the TET it would be recommended to monitor training loads and training diaries to establish trends of recovery responses to prevent decrements in performance.

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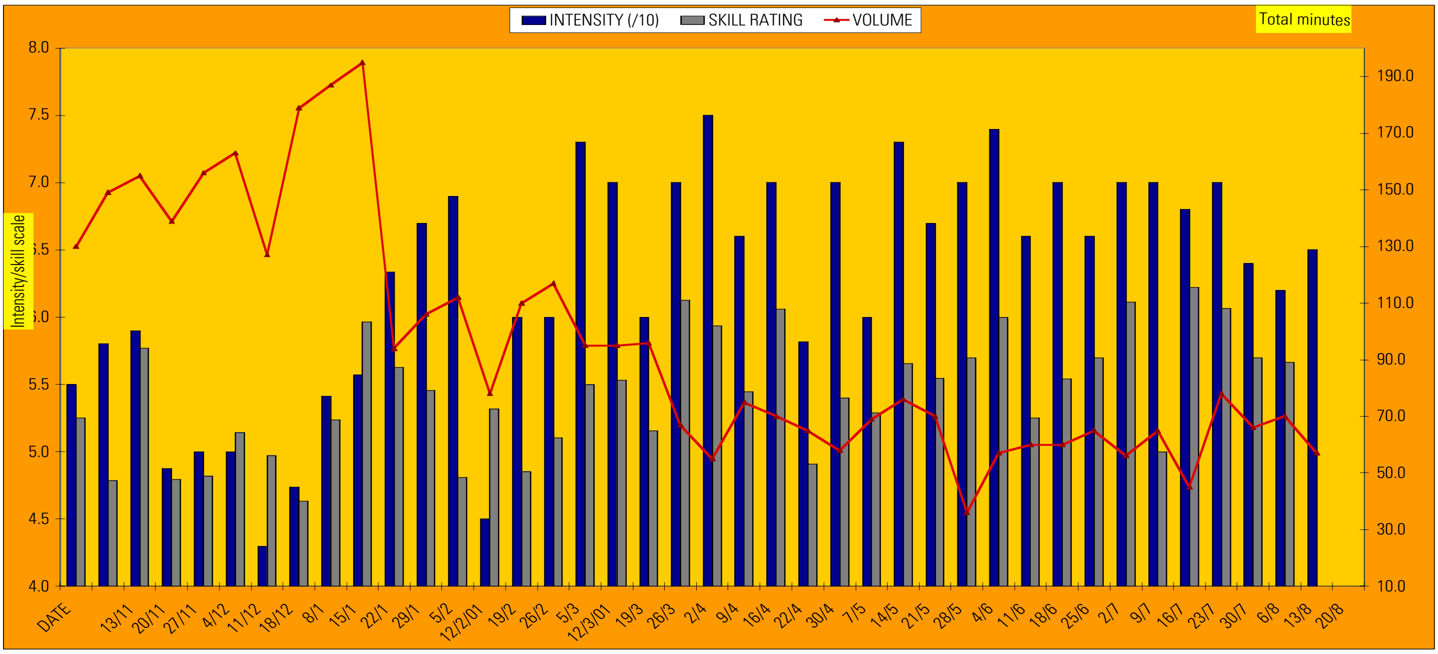
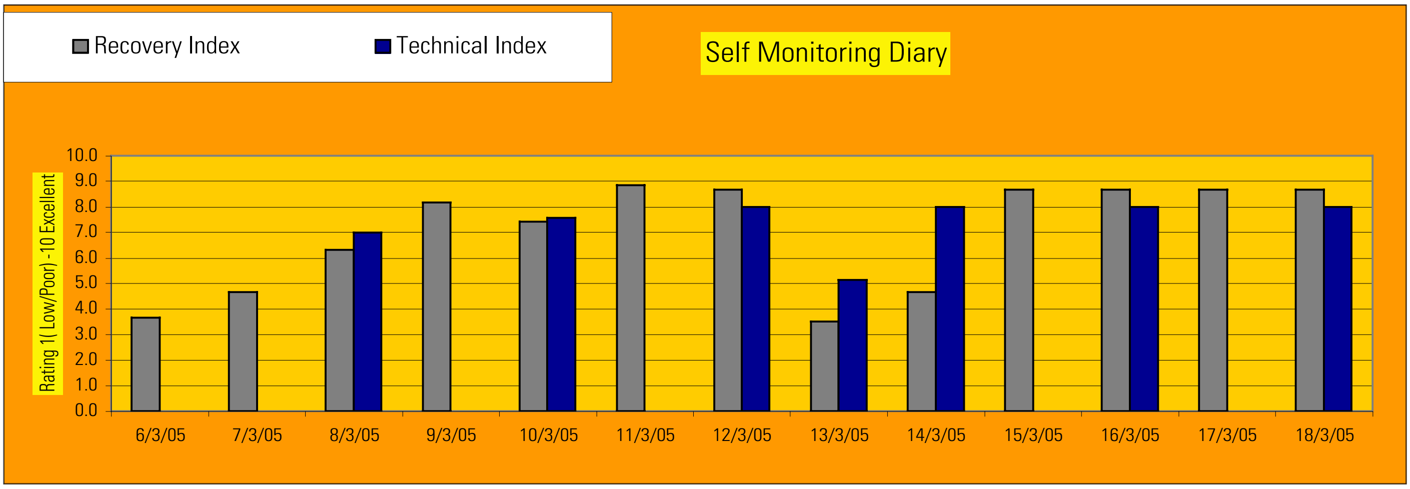
Weekly Training Load of the Collingwood Football Club 2001 AFL Season



Self Monitoring Diary

Training Responses	5-Mar	6-Mar	7-Mar	8-Mar	9-Mar	10-Mar	11-Mar	12-Mar	13-Mar	14-Mar	15-Mar	16-Mar	17-Mar
Muscle Soreness	2	4	6	9	7	9	9	2	4	9	9	9	9
Energy Levels	2	4	6	8	7.5	9	8	2	2	8	8	8	8
Sleep Quality	4	4	6	9	8	9	9	5	6	9	9	9	9
Recovery Interventions	5	5	7	8	8	8	8	3	5	8	8	8	8
Diet	6	6	8	7	8	9	9	6	6	9	9	9	9
ROM/tightness	3	5	5	8	6	9	9	3	5	9	9	9	9
Stress/ Mood/ Mental State	5	6	5	8	6	9	9	6	7	9	9	9	9
Recovery Index	**3.7**	**4.7**	**6.3**	**8.2**	**7.4**	**8.8**	**8.7**	**3.5**	**4.7**	**8.7**	**8.7**	**8.7**	**8.7**
General Kicking			7		7		8	5	8		8		8
Goal Kicking			6		6		8	6	8		8		8
Marking			7		8		8	5	8		8		8
Intensity			8		8		8	4	8		8		8
Ground Level			7		8		7	6	7		7		7
Contested marking			6		8		8	5	8		8		8
General marking			8		8		9	5	9		9		9
Technical Index			**7.0**		**7.6**		**8.0**	**5.1**	**8.0**		**8.0**		**8.0**


Recovery Index
Technical Index
Self Monitoring Diary
Rating 1(Low/Poor) - 10 Excellent
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
6/3/05
7/3/05
8/3/05
9/3/05
10/3/05
11/3/05
12/3/05
13/3/05
14/3/05
15/3/05
16/3/05
17/3/05
18/3/05